

REMARKS/ARGUMENTS

The foregoing amendment is presented to expedite prosecution and place the application in condition for allowance.

A request for a three-month extension of time, together with the associated fee, is filed herewith.

The claims in the case are Claims 21 to 48.

New Claim 48 is similar to Claim 21 and adds the additional feature defining elemental silicon present as grains of nanometer size embedded in the glassy silica matrix. Basis is found on page 8, lines 30-31. No new matter is presented in new Claim 48.

The claims have been amended to specify that the nano-composite products are fully glassy and black as noted in example 1, page 7, line 29. This feature aids in clearly distinguishing the products of this invention from what is described by *Mutti, et al.*

The rejections of Claims 21-47 under 35 U.S.C. § 102(b) or alternatively, under 35 U.S.C. § 103(a), are traversed and reconsideration is respectfully requested. The Final Office Action relies on *Mutti, et al. (Applied Physics Letters, vol. 66, no. 7, 1995, pgs. 851-853)*.

Briefly summarized, the present invention relates to nanocomposite materials that are photoluminescent at ambient temperatures in the visible red or infrared regions. Nanocomposite materials are featured by containing at least one material the crystals of which have dimensions in the range of nanometers.

The application, on pg. 1, beginning at line 11, explains the general background relating to photoluminescence in silicon. That section of the application also introduces the subject of

nanocomposite materials. Nanocomposite photoluminescent materials have potential application as light sources, as well as for use in electronic devices.

State of the art is discussed on page 2 of the application, including references to several articles from the *Journal of Applied Physics*, including the article of *Mutti, et al.*, see line 16. Applicants respectfully submit that *Mutti, et al.* neither anticipates nor renders *prima facie* obviousness the subject matter of Claims 21-48 in the application.

Mutti, et al., cited in the application on page 2, line 16, discloses the method of preparation of the samples on page 852 left column, paragraph 1. According to the authors, the samples were prepared by implantation of 160 keV $^{28}\text{Si}^+$ ions into SiO_2 -layers, thermally grown on (100)-oriented p-doped silicon substrates; see page 853, col. 1, first paragraph.

The thickness of the SiO_2 -layers is indicated as 430 nm. The implanted region is at a depth comprising between 180 and 320 nm below the surface. This means that the Si^+ ions are not equally distributed in the SiO_2 -layer. Instead, the samples show a sandwich structure, because the SiO_2 -layer has a thickness of 430 nm and the Si ions are only implanted at a region between 180 and 320 nm below the surface. Therefore, the upper Si-free layer extends from the surface down to 180 nm then there follows the implanted Si ion layer between 180-320 nm. After that follows the second Si-free layer between 320 to 430 nm. Ion implanted layers were then thermally treated at high temperature ($T > 1,000^\circ \text{C}$) in a controlled N_2 atmosphere.

Mutti only discloses a method to make a non-uniform, sandwich type SiO_2 -layer which has a thickness of 430 nm and which is thermally grown on a silicon substrate.

In contrast to *Mutti, et al.*, applicants' process is a sol-gel process which is completely different from the ion implantation method using 160 keV $^{28}\text{Si}^+$ ions. Moreover, applicants'

products are fully glassy and black, not the sandwich layered product of *Mutti, et al.* In order for the PTO to properly reject a product by process claim, the PTO must provide a rationale tending to show that the claimed product appears to be the same or similar to that of the prior art; see MPEP 2113. No rationale has been presented in this case to shift the burden to applicants to come forward with evidence to support patentability. Consequently, the Office Action of April 19, 2005 does not establish that *Mutti, et al.* describes the claimed subject matter within the meaning of 35 U.S.C. § 102.

No similarity has been shown between the *Mutti, et al.* process and applicants. Neither are there any suggestions, reasons or motivation in *Mutti, et al.* whereby a person skilled in the art would arrive at the process of producing the product or the product itself as defined in the present claims. Nothing would lead a person having ordinary skill in the art to change the *Mutti, et al.* method of making the substances so as to arrive at a glassy and black product having photoluminescence in the infrared region at ambient temperature and having infrared absorbance.

The method by which silicon nanocomposites are made has a determining influence on the properties of the product. See, for example, *Mutti, et al.*, page 851 left column:

...Also, from the fundamental point of view, the possibility to produce silicon nanocrystals by silicon implantation enables one to rule out some of the alternative mechanisms which have been proposed to explain the luminescence of porous silicon like the presence of Si_mH_n compounds, if materials not containing hydrogen are used for the implantation, or stress in the nanocrystals, if an adequate thermal recovery is performed.

Mutti, et al. thus acknowledges that luminescence depends on the method of preparation. Applicants' method of preparation is not disclosed by *Mutti, et al.*


In summary, the Office Action does not contain any reason or suggestion, or provide an explanation of motivation, for a person skilled in the art to select the reactive conditions defined herein with the expectation of obtaining a successful product with the characteristics as defined in the claims.

For the reasons set forth above, applicants respectfully submit that the rejections are not proper and should be withdrawn.

Favorable action at the Examiner's earliest convenience is respectfully requested.

Respectfully submitted,

SMITH, GAMBRELL & RUSSELL, LLP

By: 
Robert G. Weilacher, Reg. No. 20,531

Suite 3100, Promenade II
1230 Peachtree Street, N.E.
Atlanta, Georgia 30309-3592
Telephone: (404): 815-3593
Facsimile: (404): 685-6893